

ABSTRACT OF THE DISCLOSURE

A solid-state energy converter with a semiconductor or semiconductor-metal implementation is provided for conversion of thermal energy to electric energy, or electric energy to refrigeration. In n -type heat-to-electricity embodiments, a highly doped n^* emitter region made of a metal or semiconductor injects carriers into an n -type gap region. A p -type layer is positioned between the emitter region and gap region, allowing for discontinuity of corresponding Fermi-levels and forming a potential barrier to sort electrons by energy. Additional p -type layers can optionally be formed on the collector side of the converter. One type of these layers with higher carrier concentration (p^*) serves as a blocking layer at the cold side of the converter, and another layer (p^{**}) with carrier concentration close to the gap reduces a thermoelectric back flow component. Ohmic contacts on both sides of the device close the electrical circuit through an external load to convert heat to electricity. In the case of a refrigerator, the external load is substituted by an external power supply.

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WORKMAN NYDEGGER
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111